Lake the two layers in the thermocline that were more transparent than the epilimnion were only a few centimeters thick. In some series certain layers in the hypolimnion were more transparent than the epilimnion.

Preliminary tests show that part of the material which causes the lower transparency can be removed from the water with a high-speed centrifuge. In one case Daphnias were found in considerable numbers in the layer with low transparency; plate counts also show that bacteria are more numerous in the layers with minimum than in those with maximum transparency.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

USE OF THE LANTERN FOR OBJECTIVE EXAMINATIONS

THIS method has been used with large classes in elementary physiology in the General College and other divisions of the University of Minnesota.

At the beginning of the term each student is assigned to either an odd or an even numbered seat. Sometimes the class is merely divided into odds and evens and told to take seats accordingly. The odds are known as Division A, the evens as Division B.

Each student receives a stapled packet of about 25 mimeographed slips, 11 by 4½ inches, pink for A's and blue for B's. Students are instructed to bring these slips to lectures. The slips have space for student's name and 25 numbered blanks for answers to questions. At the top is instruction for A's to answer only "A" questions, B's only "B" questions.

Slides of ordinary type and size are used. The usual slide holder permits illumination of an area 3 by 3½ inches. Judicious whittling will increase the area exposed to 3¼ by 3½, the cover glasses being bound together only at ends. On this area six short questions can usually be typed, three A's and three B's. If questions are longer, four are typed on each slide.

The "Radio-Mat" method of typing slides is used. However, as sold, these expose an area of only 2¼ by 3 inches. We find it cheaper and more convenient to buy the red copying paper and Cellophane in letter-size sheets, cutting the copies into proper size before mounting between glasses.

Any of the ordinary objective types of questions may be used. Omission of unnecessary words and use of understood abbreviations shorten questions and increase number on each slide.

A sample slide, alternative answer type, is shown below. Students understand the symbol / as separating alternative answers and equivalent to the word "or." The same questions are given to both divisions but in different order.

A1 Conditioned reflexes investigated: Pavlov/Sherrington/Cannon/Magendie.

A2 Example involuntary non-reflex activity: constriction pupil/ciliary action/goose flesh/swallowing.

A3 Chief motor tracts cross: cerebrum/cerebellum/medulla/cord.

B1 Respiratory center located: cerebrum/cerebellum/medulla/cord.

B2 Example smooth muscle reflex: sneezing/winking/knee jerk/blush.

B3 Autonomic N.S.: wholly efferent/wholly afferent/mixed.

Teachers having lanterns for opaque projection could doubtless make direct use of typewritten questions.

A quiz may include any number of questions. We have used ten to fifty. Usually one purpose has been to take a roll call and check tardiness. Unannounced quizzes of ten questions served these purposes.

Almost no cheating has been observed. Although in adjacent seats, the odds and evens are too busy concentrating on their respective jobs.

Slides are filed for use with future classes. Usually copies of questions are posted after quizzes.

Last year we experimented with two lanterns. This method has the advantage of permitting a larger number of questions on view at a given time, "A"s on one screen, "B"s on the other. It also makes it easier to use multiple choice answers, questions on one slide, answers on the other.

Several members of the physiology staff made useful suggestions, especially Drs. Hugo Miller and Carroll Bellis.

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APPARATUS FOR PRODUCING CUMULATIVE AND ORDINARY TYPE KYMOGRAPH RECORDS SIMULTANEOUSLY

A QUANTITATIVE representation of physiological data given by the ordinary type kymograph record would, in many instances, be of advantage, particularly so in the comparison of sets of data. A method has been described[1] by which this may be accomplished in measuring the activity of small animals. The present article presents a method applicable to a much wider range of experimentation. A simple muscle preparation will serve to illustrate the method.

[1] K. M. Wilbur, SCIENCE, 84: 2177, 274, 1936.

An oiled glass rod (R) of ⅛″ diameter forms a support for a sliding wire collar to which is attached a writing lever (L), resting against a horizontal kymo-

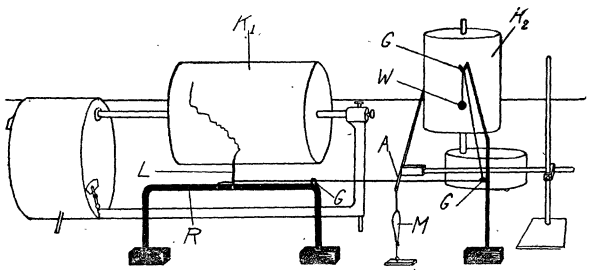

FIG. 1

graph drum (K1). Less than 50 milligrams were required to produce movement of the writing lever, even when no special precautions were taken to insure ease of movement of the sliding collar and the writing lever. A silk thread passes from the sliding collar through three glass loops (G). The thread is weighted with a small piece of plastic clay (W). The short arm of a muscle lever (A) extends over the thread. Two glass rods (not shown in figure) on either side of the muscle lever allow only vertical deflection of the thread. The contraction of the muscle (M) pulls down lever (A) causing the thread to be depressed. The depression of the thread causes the writing lever to be pulled to the right, since the weighting arrangement does not permit the other end of the thread to move. When the muscle relaxes the weight drops slightly, pulling the thread taut without further displacing the writing lever. Thus, the lever will move only during contraction, and the curve produced will be cumulative as the muscle contracts. The greater the frequency of contraction the more rapid will be the rise of the curve. The curve will also rise more rapidly if the amplitude of contraction is increased. Simultaneous with the making of the cumulative record on K1 another record of the usual type is being obtained on K2. Both the change in frequency and amplitude will be indicated in the cumulative curve, although less clearly than in the ordinary record, since each contraction is represented by a discrete step in the curve. The height of the curve at any point will be proportional to the total contraction up to that time.

By a slight modification of the apparatus records may be obtained from levers moved by rubber tambours.

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ANOTHER CARBORUNDUM PENCIL

WE have been using in our classes a method of mounting engravers' points for marking microscope slides which seems both simpler and more satisfactory than that devised by Chatters.[1]

Glass tubing just large enough for insertion of an engravers' point is selected and cut in four-inch lengths. With the aid of heat the blunt end of a piece of carborundum is coated with a thin layer of sealing wax, and while the wax is still soft the carborundum is inserted to about half its length in one end of the glass tubing. The student's name is then written in India ink on a narrow piece of card, which is pushed into the tube far enough to avoid scorching when the open end is either fire polished or sealed.

Pieces of carborundum mounted in this way have been in use in the histology class at Yale for several years. The insertion of a name card was the idea of a student at Smith.

ESTHER CARPENTER

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[1] SCIENCE, 85: 128, January 29, 1937.

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